

Jan. 1, 1963

G. M. RAULINS

3,071,188

REMOTELY CONTROLLED LATCH FOR WELL TOOLS

Filed Oct. 29, 1958

5 Sheets-Sheet 1

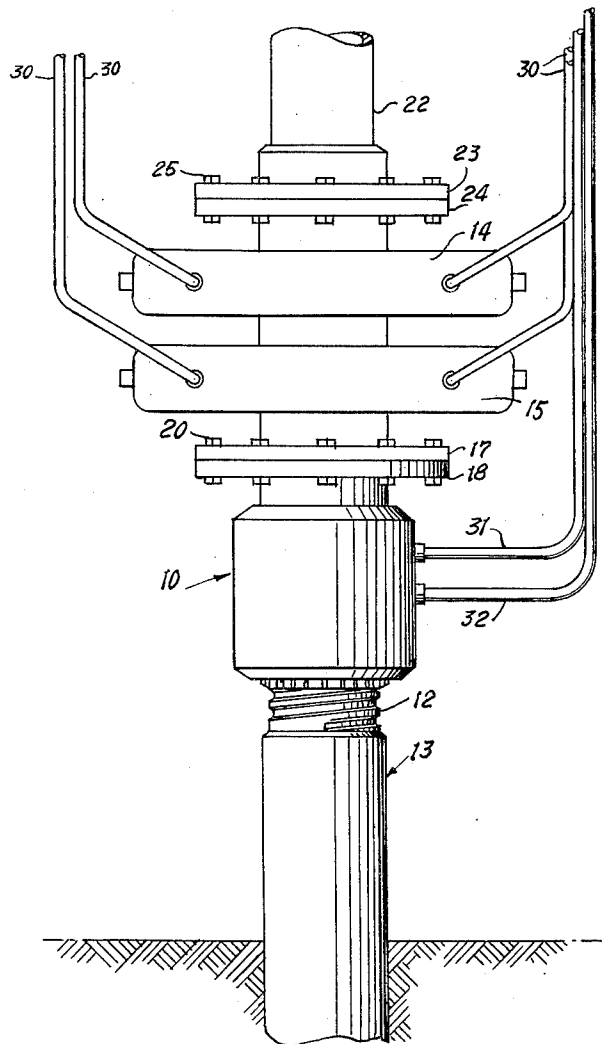


Fig. 1

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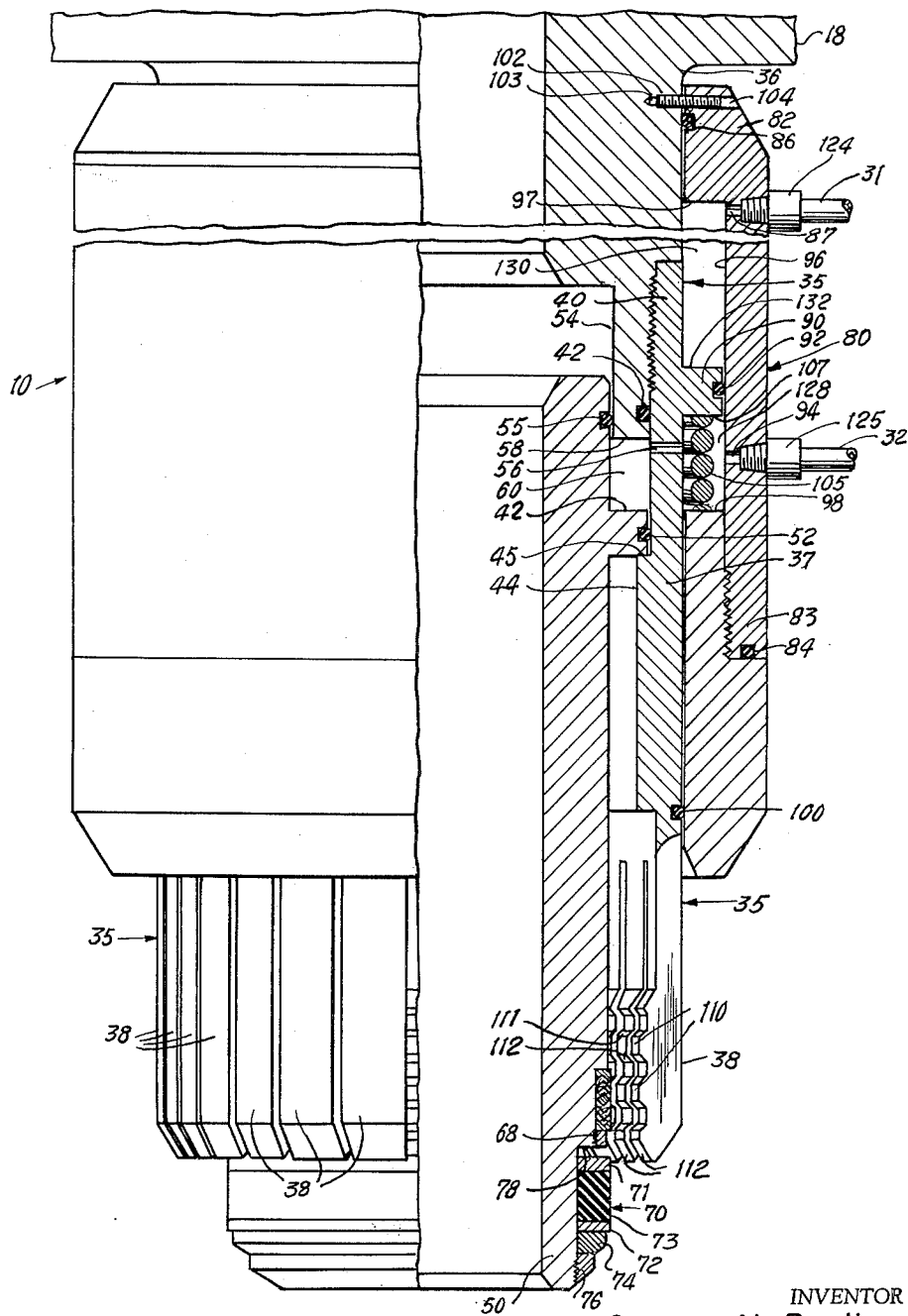


Fig. 2

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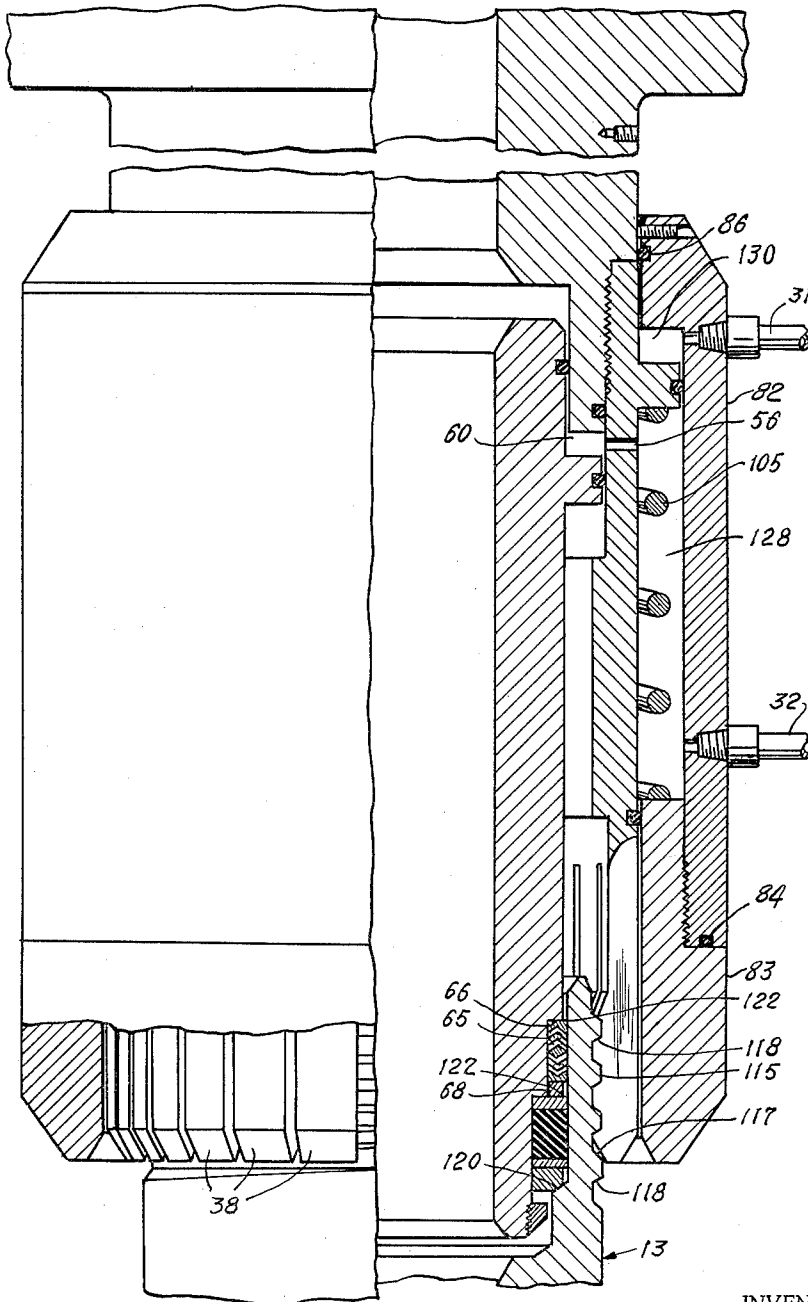
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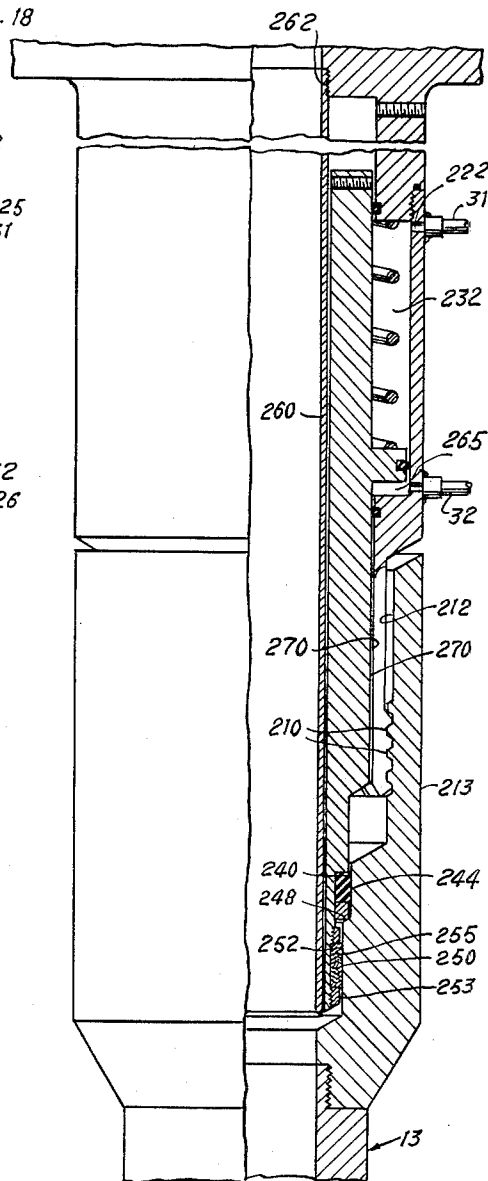
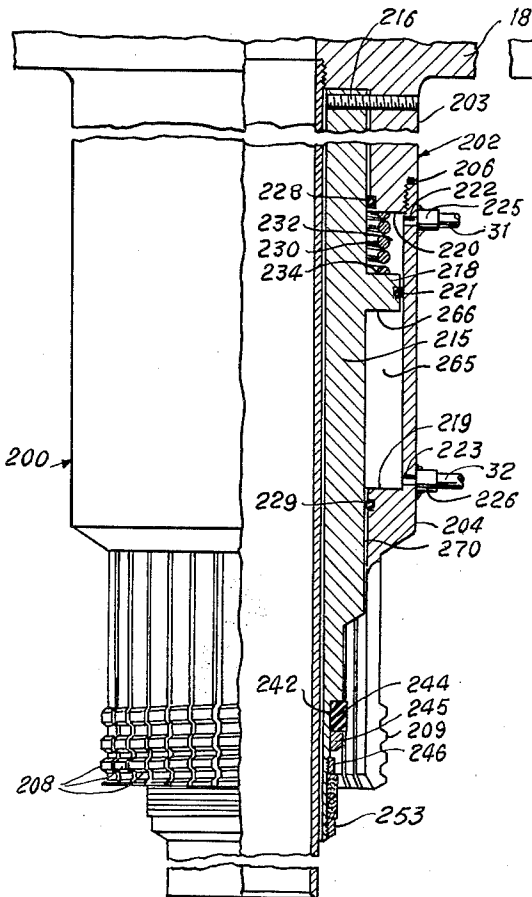
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5 Sheets-Sheet 4



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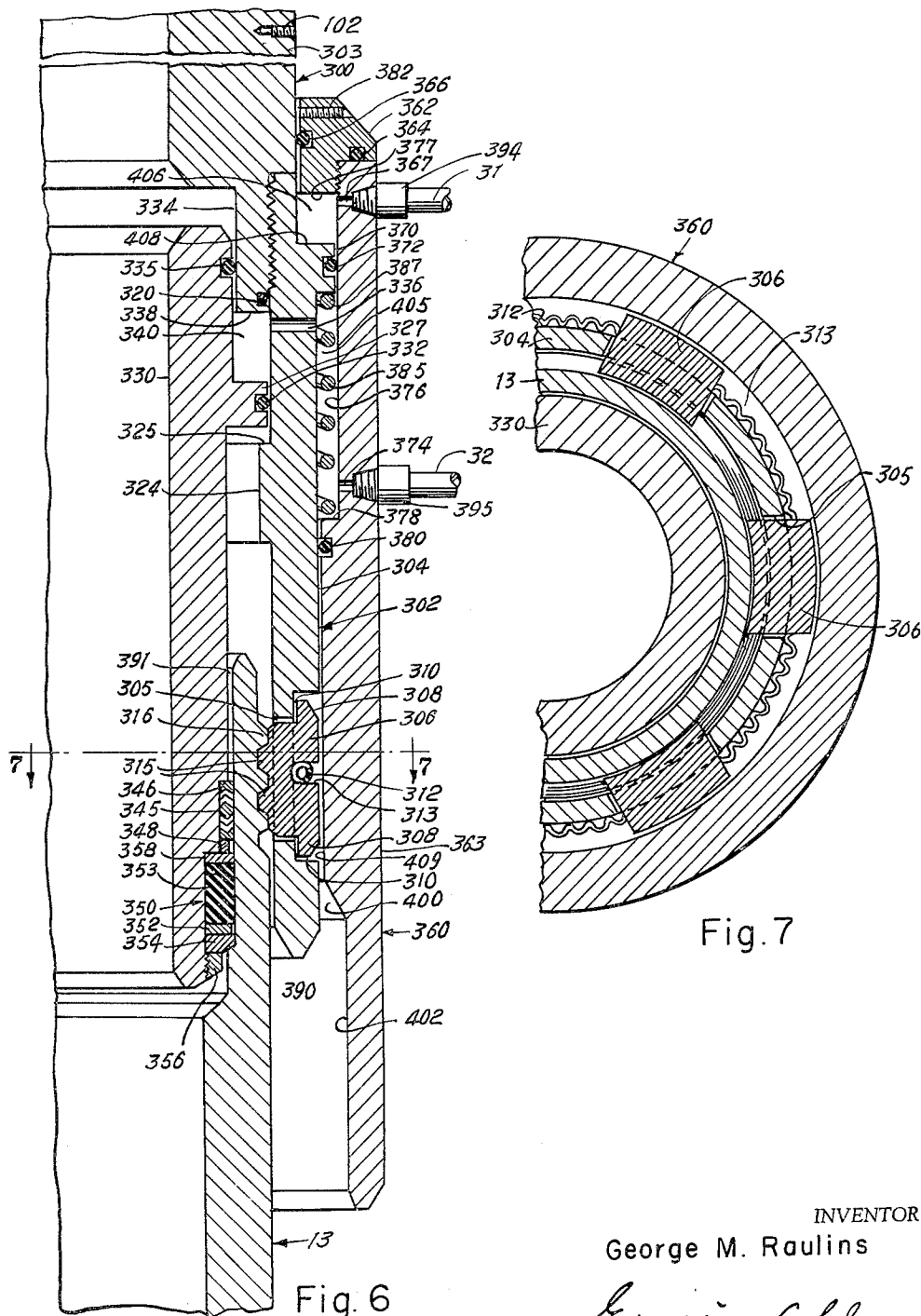


Fig. 7

Fig. 6

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3,071,188 REMOTELY CONTROLLED LATCH FOR WELL TOOLS

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Filed Oct. 29, 1958, Ser. No. 770,505
26 Claims. (Cl. 166-66.5)

This invention relates to well tools and more particularly to latch means for securing well tools, such as blowout preventers or the like, to a well head.

An object of this invention is to provide a new and improved latch means for securing well tools to a well head.

Another object is to provide a latch means for releasably securing a well tool to a well head.

Another object of the invention is to provide a latch means for releasably securing a blowout preventer or the like to a well head.

Still another object is to provide a latch means for securing a blowout preventer or the like to a well head which is controllable from a location remote from the well head.

A still further object of this invention is to provide a latch means, which is remotely controlled, for releasably securing a blowout preventer or the like to a well head.

A further object is to provide a latch means for securing a blowout preventer or the like to a well head which permits the blowout preventer to be disconnected from the well head upon rotation relative to the well head or upon longitudinal movement relative to the well head.

A still further object of the invention is to provide a latch means for securing a blowout preventer or the like to a well head which provides a seal means for providing a fluid type seal between the latch means and the well head.

A still further object of the invention is to provide a latch means for a well head which includes an inner sleeve telescopic into the well head and provided with sealing means to seal therebetween, a collet means having resilient fingers engageable with threads provided on the well head for releasably connecting a blowout preventer or the like to the well head, and an outer sleeve longitudinally movable on the collet for locking the collet fingers in locking engagement with the threads of the well head.

A still further object is to provide a latch means wherein the outer sleeve is movable between locking and inoperative positions by means which may be remotely controlled.

Another object is to provide a latch means wherein the outer sleeve is movable between locking and inoperative positions by hydraulic fluid transmitted from remote locations.

Still another object of the invention is to provide a latch means wherein the outer and inner sleeves and the collet provide pressure chambers to which fluid under pressure may be admitted to move the sleeves downwardly on the collet to cause the inner sleeve to seal with the well head and the outer sleeve to lock the collet fingers on the threads of the well head.

Still another object of the invention is to provide a seal means on the inner sleeve which are expanded into sealing engagement with the well head upon downward

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movement of the sleeve in the well head, the well head being provided with an internal annular shoulder for engaging the seal means upon downward movement of the inner sleeve in the well head.

A still further object of the invention is to provide a latch means wherein the pressure chamber to which fluid under pressure is admitted to cause the outer sleeve to move downwardly on the collet to lock the collet fingers on the threads of the well head may be filled with plastic fluid which sets or hardens to prevent movement of the outer sleeve toward inoperative position.

A still further object of the invention is to provide a latch means for securing a blowout preventer or the like to a well head which includes a collet rigidly securable to the blowout preventer having collet fingers engageable with the threads of a well head and a locking means movable longitudinally relative to the collet and to the well head for releasably locking the collet fingers to the threads of the well head.

Additional objects and advantages of the invention will be readily apparent from the reading of the following description of a device constructed in accordance with the invention, and reference to the accompanying drawings thereof, wherein:

FIGURE 1 is a side view of a well head to which a blowout preventer is releasably secured by the latch means embodying the invention;

FIGURE 2 is a fragmentary, partly sectional view of the latch means illustrated in FIGURE 1;

FIGURE 3 is a fragmentary, partly sectional view showing the latch means illustrated in FIGURE 2 secured to the upper threaded end of a well head;

FIGURE 4 is a fragmentary, partly sectional side view of a modified form of the latch means;

FIGURE 5 is a partly sectional side view showing the latch means illustrated in FIGURE 4 releasably connected to a wellhead;

FIGURE 6 is a fragmentary partly sectional side view of still another modified form of the latch means showing it releasably connected to a wellhead; and

FIGURE 7 is a sectional view taken on line 7-7 of FIGURE 6.

Referring now particularly to FIGURES 1, 2 and 3 of the drawings, the latch 10 embodying the invention is illustrated connected to the threaded upper end 12 of the well head 13. The latch has a pair of blowout preventers 14 and 15 rigidly connected to its upper end by means of the flanges 17 and 18 on the latch and on the lowermost blowout preventer 15 by means of the usual bolts 20. A guide pipe 22 is similarly connected to the upper blowout preventer 14 by means of the flanges 23 and 24 of the guide pipe and of the uppermost blowout preventer which are rigidly secured together by the usual bolts 25. The blowout preventers 14 and 15 prevent flow of fluids between the guide pipe and a drill pipe which is extendable through the guide pipe, the blowout preventers and latch 10 into the well head 13. The blowout preventers are controlled by hydraulic fluid transmitted thereto through conduits 30 in the conventional manner. The latch 10 is remotely controlled by means of a hydraulic fluid which is conveyed to the latch 10 by means of the conduits 31 and 32.

The latch 10 may be used to secure the blowout preventers 14 and 15, and the guide pipe 22 which is attached thereto, a well head 13 which may be disposed beneath the body of water. The operation of the latch

10 is controlled from the surface by means of the hydraulic fluid which is transmitted to the latch 10 through the conduits 31 and 32. The latch 10 includes a collet 35 having an upper section 36 provided with an integral flange 18 and a lower section 37 threaded into the upper section and provided with a plurality of collet fingers 38. The lower section 37 of the collet 35 is provided with an upstanding external flange 40 which is threaded into the lower end of the upper section. The upper section is provided with an external annular groove in which is disposed an O ring 42 which seals between the two sections of the collet. The lower section 37 of the collet 35 is provided with an internal annular flange 44 which provides an upwardly facing annular stop shoulder 45 which engages an external flange 47 of an inner sleeve 50 to limit downward longitudinal movement of the inner sleeve in the collet. The flange 47 is provided with an external annular recess in which is disposed an O ring 52 which seals between the collet 35 and the inner sleeve to prevent flow of fluids therebetween.

The inner bore of the collet 35 is reduced in an intermediate portion to provide a seal surface 54 which is engageable by O ring 55 disposed in an annular recess in the upper portion of the inner sleeve which prevents flow of fluid between the collet 35 and the inner sleeve 50 above a lateral port 56 of the collet 35. The O ring 52 seals between the collet 35 and the inner sleeve 50 below the lateral port 56. The flange 47 and the downwardly facing shoulder 58 of the collet 35 thus define a pressure chamber 60 into which pressure or hydraulic fluid may flow through the lateral port 56 to cause the inner sleeve 50 to move downwardly on the collet 35.

The inner sleeve 50 is provided adjacent its lower end with a packing or seal means 65, which may be of the chevron type, which is held between a downwardly facing shoulder 66 of the inner sleeve and a retainer ring 68 threaded on the inner sleeve. A second seal assembly 70 is mounted on the reduced lower end of the inner sleeve and includes a pair of backup rings 71 and 72 which are disposed on opposite sides of a resilient seal element 73 and a slide ring 74 disposed below the lower backup ring 72. The seal assembly 70 is held on the reduced lower end of the inner sleeve by means of a retainer ring 76 threaded on the inner sleeve. The backup rings 71 and 72 may be formed of lead or other soft deformable substance which will flow outwardly when subjected to pressure caused by the slide ring 74 moving the assembly upwardly against the downwardly facing annular shoulder 78 of the inner sleeve.

An outer locking sleeve 80 is mounted on the exterior of the collet 35 for limited longitudinal movement thereon. The locking sleeve 80 includes an upper section 82 threaded on a lower section 83. The upper section 82 of the locking sleeve is provided with a downwardly facing annular recess in which is disposed an O ring 84 which seals therebetween to prevent flow of fluid therepast. The upper section 82 is provided with an internal annular recess in which is disposed a similar O ring 86 which seals between the collet and the outer locking sleeve 80 above a lateral port 87 provided in the lower section 83 of the locking sleeve. The collet is provided with an external annular flange 90 which in turn is provided with an external annular recess in which is disposed an O ring 92 which seals between the collet and the locking sleeve below the lateral port 87 and above the lateral port 94 of the locking sleeve.

The locking sleeve is provided with an internal annular recess 96 defined by the downwardly facing shoulder 97 of the upper section 82 and the upwardly facing shoulder 98 of the lower locking sleeve section 83 in which is disposed the external annular flange 90 of the collet 35. The collet is also provided with an external recess below its lateral port 56 in which is disposed an O ring 100 which seals between the collet and the lower section 83 of the outer sleeve below the lateral port 94.

The outer locking sleeve 80 is releasably held in upper inoperative position by means of a shear screw 102 which is threaded in a suitable lateral bore 103 of the collet 35 and which extends through a suitable bore 104 of the upper section 82 of the locking sleeve. The locking sleeve is biased downwardly on the collet 35 by a spring 105 disposed in the internal recess 96 of the locking sleeve which has its opposite ends bearing against the upwardly facing shoulder 98 of the locking sleeve and the downwardly facing shoulder 107 of the external flange 90 of the collet 35.

The collet fingers are provided with internal bosses 110 having inwardly convergent upper and lower shoulders 111 and 112 respectively. The lowermost boss 110 has its upwardly and inwardly convergent surface 112 extending outwardly to a greater distance than the other lower surfaces 112 of the upper bosses in order to facilitate outward flexing of the collet fingers 38 as such lower surface 112 of the lowermost boss engages the threads 115 of the well head 13. The threads 115 have upper and lower outwardly convergent surfaces 117 and 118 which correspond in configuration to the lower and upper surfaces of the bosses 110 of the collet fingers 38 so that the bosses 110 will fit in and be received between the threads 115 and similarly the threads 115 will be received and fit between the bosses 110 of the collet fingers 38, the bosses 110 being arranged in a helixes of the same pitch as the threads 115.

The well head is provided with an interior upwardly facing beveled shoulder 120 which is adapted to engage the slide ring 74 of the lower seal assembly 70 whereby it causes the seal assembly to be compressed against the shoulder 78 when the inner sleeve 50 is moved downwardly in the well head 13 to cause the seal element 73 to engage the inner surface of the well head 13 and thus seal between the inner sleeve and the well head. The backup rings 71 and 72, being of lead or a similar flowable substance, will also tend to be deformed into engagement with the sealing surface 122 of the well head 13 and thus also serve to help seal therebetween. The upper seal 65 also seals between the inner sleeve and the seal surface 122 of the well head.

The conduits 31 and 32 are connected to the ports 87 and 94 of the outer locking sleeve 80 by means of suitable fittings 124 and 125 which are threaded in outer portions of the lateral ports 87 and 94, respectively.

In use, when it is desired to secure the blowout preventers 14 and 15 and the guide pipe 22 to the well head 13, which may be located below the surface of a body of water, the latch 10 is secured to the blowout preventers by means of the flanges 17 and 18 and bolts 20. The guide pipe 22 is similarly connected to the upper blowout preventer 14 by means of the flanges 23 and 24 and the bolts 25. This assembly is made above the surface of the water. The elements of the latch are then in the position shown in FIGURE 2 with the outer locking sleeve 80 held in its upper position against the resistance of the spring 105 by means of the shear screw 102. The entire assembly is then lowered downwardly through the water until the lower portion of the inner sleeve 50 enters into the wellhead 13. The collet fingers 38 then flex outwardly as they pass over the threads 115 of the wellhead until they assume the position shown in FIGURE 3. The bores of the collet, the inner sleeve and the wellhead are now in alignment and the seal 65 and the O ring 55 now prevent the flow of fluids between the inner sleeve and the wellhead and the collet, respectively.

The latch 10 is now secured to the wellhead 13 by the engagement of the bosses 110 and the collet fingers 38 with the external threads 115 of the wellhead but can be disengaged from the wellhead by an upward force due to the downwardly and inwardly sloping configuration of the upper surfaces 111 of the bosses 110 of the collet fingers and the upwardly and outwardly inclined lower surfaces 118 of the threads 115 which will cam the col-

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let fingers 38 outwardly when an upward vertical force is applied to the collet 35. When it is desired to lock the latch 10 in engagement with the wellhead the pressure of the hydraulic fluid in the conduit 32 is increased to increase the pressure in the chamber 128 between the collet and the outer sleeve and between the downwardly facing shoulder 107 of the flange 90 and the upwardly facing shoulder 98 of the locking sleeve. Simultaneously, the upper end of the conduit 31 is opened to permit outward flow of fluid from the chamber 130 between the locking sleeve 80 and the collet 35 and between the downwardly facing shoulder 97 of the locking sleeve and the upwardly facing shoulder 132 of the external flange 90 of the collet. When the pressure of the hydraulic fluid in the chamber 128 reaches a predetermined value, the shear screw 102 shears to permit the locking sleeve 80 to move downwardly. The force of the hydraulic fluid in the chamber 128 and the force of the spring 105 causes the locking sleeve to move downwardly from the position shown in FIGURE 2 to the position shown in FIGURE 3 wherein its lower end extends about the upper portions of the collet fingers 38 preventing the collet fingers from flexing outwardly. The latch 10 cannot now, therefore, be forced or removed from engagement with the wellhead by an upward force exerted thereon. It can still be removed from the wellhead, however, by rotation of the latch to threadedly disengage the bosses of the collet fingers from the threads 115 of the wellhead. The latch 10 may also be disengaged from the wellhead by increasing the pressure in the chamber 130 while simultaneously permitting outward flow of the fluid in the chamber 128 through the conduit 32 which will cause the locking sleeve 80 to move upwardly from the position shown in FIGURE 3 to the position shown in FIGURE 2 against the force exerted by the spring 105. When the locking sleeve is again in the upper position shown in FIGURE 2, the collet fingers 38 are again free to flex outwardly so that an upward force exerted on the assembly will cause the bosses 110 to cam outwardly out of engagement with the threads and thus free the blowout preventer assembly from the wellhead so that the entire assembly may be lifted therefrom. The threads 115 of the wellhead are normally right hand threads while those associated with the guide pipe are normally left hand threads so that rotation of the drill pipe in the normal right hand direction will not disengage the latch from the wellhead.

The lateral port 56 of the collet affords communication between the chamber 128 and the chamber 60 so that when the pressure in the chamber 128 is increased, it causes the outer locking sleeve to move downwardly. Such increased pressure will also be communicated to the inner chamber 60 to cause the inner sleeve 50 to move downwardly relative to the collet 35. Such downward movement of the inner sleeve 50 causes the slide ring 74 to engage the upwardly facing shoulder 120 of the wellhead to compress the seal assembly 70 and thus create a better seal between the wellhead and the inner sleeve 50. In the event that excessive pressures arise in the wellhead, the pressure in the chamber 60 may be increased to effect a stronger seal between the inner sleeve and the wellhead.

If desired, the hydraulic fluid which is forced into the chamber 128 may be of a thermo-setting type which solidifies or hardens with the passage of time so that after such period of time has elapsed, the locking sleeve 80 will be held in its lowermost locking position not only by the force of the spring 105 but also by the now solidified substance which fills the lower chamber 128. The necessary heat is provided by the well fluids which flow through the assembly or the hydraulic fluid may be heated at the surface and pumped into the chamber while hot. The use of setting fluids, such as cement, casein glue, or the like, precludes the necessity of maintaining pres-

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sure in the conduit 32 and the chamber 128 if it is for some reason found that the force of the spring 105 is not sufficient to keep the locking sleeve 80 in its lower locking position. If the fluid employed is of the setting type, the latch may be detached from the wellhead only by rotating the latch on the wellhead.

It will now be apparent that a new and improved latch 10 for releasably connecting well tools, such as blowout preventers 14 and 15, to a wellhead 13 has been illustrated and described which includes means, the collet fingers 38, engageable with the threads on the upper end of the wellhead for releasably securing the latch to the wellhead.

It will further be seen that the releasable means are held in locked position to prevent separation of the latch from the wellhead by upward forces exerted on the latch by a locking sleeve 80 which is movable downwardly to hold the collet fingers against outward flexing movement.

It will further be seen that the locking sleeve may be moved between an upper inoperative position and a lower locking position by means of hydraulic fluid transmitted through the conduits 31 and 32 to the chambers 130 and 128 whereby the latch may be remotely controlled.

It will further be seen that the latch 10 is provided with an internal sleeve having seal means which seal between the wellhead and the inner sleeve.

It will further be seen that the lowermost seal assembly 70 on the inner sleeve may be compressed to any desired degree by an increase of the hydraulic pressure transmitted to the chambers 128 and 60 whereby the sealing action of the seal assembly may be increased whenever this is made necessary or desirable by increases in the fluid pressures within the wellhead 13.

It will further be seen that the latch 10 may be remotely controlled both to releasably lock the latch to the wellhead against upward movement thereon and to seal between the wellhead and the blowout preventers 14 and 15 due to the action of the various O rings and the seal assemblies 65 and 70 on the inner sleeve.

Referring now to FIGURES 4 and 5, a modified form of the latch 10 is illustrated. The latch 200 includes a collet 202. The collet 202 has an upper section 203 which is provided with a flange 18 by means of which the collet may be rigidly secured to the flange 17 of the blowout preventers 14 and 15. The collet 202 also has a lower section 204 which is threaded on the lower end of the upper section. The upper section has an annular downwardly facing recess in which is disposed an O ring 206 to seal between the sections and prevent flow of fluid therebetween. The lower section is provided with a plurality of collet fingers 208 which are provided with outwardly extending bosses 209 which are adapted to engage the internal threads 210 in the enlarged upper bore 212 of an adapter 213 secured to the upper end of the wellhead 13. The bosses 209 and the threads 210 have convergent upper and lower surfaces whereby the bosses 209 may cause the collet fingers 208 to flex inwardly upon engaging the threads during either upward or downward movement relative to the threads.

An internal locking sleeve 215 is releasably secured to the upper section 203 of the collet 202 by a shear screw 216 and is provided with an intermediate external flange 218 which is disposed between the upwardly and downwardly facing shoulders 219 and 220, respectively, of the collet 202. The external flange 218 is provided with an external annular flange in which is disposed an O ring 221 which seals between the locking sleeve 215 and the collet 202 between the lateral ports 222 and 223 of the collet. The conduits 31 and 32 are secured to the collet by means of fittings 225 and 226 and communicate with the lateral ports.

The collet is provided with internal annular recesses in which are received the O rings 228 and 229 which seal between the locking sleeve 215 and the collet above and below the lateral ports 222 and 223. A biasing

spring 230 is disposed in the upper chamber 232 defined by the collect and the inner sleeve and between the downwardly facing shoulder 220 of the collet and the upwardly facing shoulder 234 of the external flange 218 of the locking sleeve, the opposite ends of the spring bearing against the shoulders 220 and 234 to bias the locking sleeve downwardly relative to the collet 202.

The lower end of the locking sleeve is reduced so that it may enter into an intermediate reduced portion of the adapter 213 which provides a cylindrical seal surface 240. The reduced intermediate portion of the locking sleeve provides a downwardly facing shoulder 242 against which a seal 244 may bear. A slide ring 245 bears against the lower surface of the seal 244 and is held against downward displacement by a retainer ring 246 threaded on the lock sleeve. The slide ring 245 is adapted to bear against the upwardly facing shoulder 248 of the wellhead adapter 213 so that the lock sleeve 215 may move downwardly with respect to the slide ring 245 when the latter engages the stop shoulder 248 of the adapter 213 thus causing the seal 244 to be compressed to any desired degree against the seal surface 240.

A second seal assembly 250 is disposed on a further reduced lower portion of the lock sleeve and is held in place between a downwardly facing shoulder 252 and the retainer ring 248 by a retainer ring 253 threaded on the lower end of the lock sleeve. The seal assembly 250, which may be of the chevron type, bears against a seal surface 255 of the adapter 213.

An inner shield sleeve 260 is threaded at its upper end into a reduced bore 262 of the upper collet section 203 and extends to a point just below the lower end of the lock sleeve when the lock sleeve is in its lowermost position as shown in FIGURE 5. The shield sleeve protects the lock sleeve against contact by any of the tools which may pass through the guide pipe, the blowout preventers and the latch into the wellhead 13.

In use, the latch 200 is assembled on the blowout preventers and the guide pipe in the same manner as the latch 10. The whole assembly is lowered into the water until the collet fingers 208 enter into the adapter 213 of the wellhead and engage the threads 210 thereof. The collet fingers 208 are free to flex inwardly during such movement of the latch into the adapter 123 since the locking sleeve 215 is now in the upper position shown in FIGURE 4 and the reduced lower portion of the lock sleeve is immediately behind the collet fingers. Fluid pressure is then applied to the chamber 232 through the conduit 31 and the lateral port 222. At the same time, fluid in the chamber 265 between the lower shoulder 266 of the external flange 218 and the upper shoulder 219 of the collet 202 is permitted to escape through the lateral port 223 and the conduit 32. When the pressure in the upper chamber 232 reaches a predetermined value, the shear screw 216 shears and the fluid pressure in the chamber 232 and the biasing spring 230 cause the lock sleeve 215 to move downwardly relative to the collet causing the locking surface 270 of the locking sleeve to move behind the collet fingers 208 which are then prevented from flexing inwardly out of engagement with the threads 210. During such downward movement of the lock sleeve 215, the seals 244 and 250 move into engagement with the intermediate sealing surface 240 and the lower sealing surface 255 of the adapter and thus prevents flow of fluids between the locking sleeve and the adapter. When it is desired to effectuate a better seal, increased pressure may be caused to flow into the upper chamber 232 to cause the locking sleeve to move further downwardly relative to the adapter which in turn causes the seal 244 to be compressed to a greater degree by the slide ring 245 which now abuts the stop shoulder 248 of the adapter 213.

When it is desired to detach the latch 10 from the well-

head 13, it may be rotated to unscrew the bosses 209 of the collet fingers from the engagement with the threads 210 of the adapter. Alternately, the lock sleeve may be caused to move upwardly relative to the collet 202 by increasing the pressure of the fluids flowing through the conduit 32 into the lower chamber 265 and at the same time permitting the fluid from the upper chamber 232 to escape outwardly through the conduit 31. When the lock sleeve is thus moved by a fluid pressure back to the upper position illustrated in FIGURE 4, the collet fingers are again free to flex inwardly upon upward movement of the latch relative to the adapter 213 so that an upward force applied to the latch will now cause the latch to become detached from the wellhead 13.

It will now be seen that a new and improved latch for detachable blowout preventers and the like has been illustrated and described which includes resilient latch means, such as the collet fingers 33 of the latch illustrated in FIGURE 2 and the collet fingers 208 of the latch illustrated in FIGURE 4, which are releasably engageable with the threads provided on a wellhead 13. It will further be seen that a lock means, such as the external sleeve 80 of the internal sleeve 250, are provided which are longitudinally movable relative to the latch means to lock the latch means in their operative locking positions whereby the latch is secured against upward movement on the wellhead but may be detached if desired by rotational movement. It will further be seen that the lock sleeve is movable between its upper in-operative position and its lower locking position by means of hydraulic fluid and that the flow of such hydraulic fluid to the latches 10 and 200 may be remotely controlled. It will further be seen that the hydraulic fluid in either case may be of a setting type so that once the lock sleeve is moved to its lowermost locking position, it is rigidly held against movement from such locking position by the solidified hydraulic fluid.

Referring now particularly to FIGURES 6 and 7 of the drawing, the latch 300 there illustrated is similar to the latch 10 illustrated in FIGURES 1 and 2 having a latch sleeve 302 comprised of an upper section 303 provided with an integral flange, not shown, similar to the integral flange 18 by means of which the latch sleeve may be secured to the flange 17 of the blowout preventers 14 and 15 by bolts 20 as shown in FIGURE 2. The latch sleeve also is provided with a lower sleeve section 304 threaded into the upper section. The lower latch sleeve section 304 is provided with a plurality of circumferentially spaced apertures 305 in which are movably disposed the dogs 306. The dogs are provided with upper and lower flanges 308 which are adapted to engage the shoulders 310 of the lower latch sleeve section 304 adjacent the apertures 305 to limit inward movement of the dogs relative to the latch sleeve. The dogs are biased inwardly by a garter spring 312 which extends through the aligned transverse slots 313 of the dogs.

The dogs are provided with teeth 315 having inwardly convergent upper and lower shoulders which correspond in configuration to the threads 316 of the wellhead 13. Since the upper and lower shoulders of the threads 316 converge outwardly, it will be apparent that the camming action between the shoulders of the teeth of the dogs and of the threads will cause the dogs to be cammed outwardly, if free to do so, upon upward or downward movement of the latch sleeve over the upper end of the wellhead and over the threads 316 thereof. It will be apparent that the teeth 315 of the various dogs 306 are arranged in a helix so that corresponding teeth of adjacent dogs 306 will be displaced vertically to accommodate to the pitch of the threads 316.

It will be apparent that, if desired, the wellhead 13 may be provided with a plurality of annular flanges, instead of the threads 316, having outwardly converging shoulders, in which event all dogs would be of identical con-

figuration having teeth 315 which are aligned in circular form.

The upper latch sleeve section 303 is provided with an external annular groove in which is disposed an O ring 320 which seals between the two sections of the latch sleeve. The lower latch sleeve section 304 is provided with an internal annular flange 324 having an upwardly facing stop shoulder 325 which engages an external flange 327 of an inner sleeve 330 in the latch sleeve. The flange 327 is provided with an external annular recess in which is disposed an O ring 332 which seals between the latch sleeve 302 and the inner sleeve to prevent flow of fluids therebetween.

The inner bore of the upper latch sleeve section 303 is reduced in an intermediate portion to provide a seal surface 334 engageable by an O ring 335 disposed in an annular recess in the upper portion of the inner sleeve which prevents flow of fluid between the latch sleeve and the inner sleeve above the lateral port 336 of the latch sleeve. The O ring 332 seals between the latch sleeve 302 and the inner sleeve 330 below the lateral port 336. The flange 47 and the downwardly facing shoulder 338 of the latch sleeve 302 thus define a pressure chamber 340 into which a pressure or hydraulic fluid may flow through the lateral port 336 to cause the inner sleeve to move downwardly on the latch sleeve.

The inner sleeve is provided near its lower end with a packing or seal means 345, which may be of the chevron type, held between a downwardly facing shoulder 346 and a retainer ring 348 threaded on the inner sleeve.

The second seal assembly 350 is mounted on the reduced lower end of the inner sleeve and includes a pair of back-up rings 351 and 352 disposed on opposite sides of a resilient seal element 353 and a slide ring 354 disposed below the lower back-up ring 352. The seal assembly 350 is held on the reduced lower end of the inner sleeve by means of a retainer ring 358 threaded on the inner sleeve. The back-up rings 351 and 352 may be formed of lead or other soft deformable substance which will flow outwardly when subjected to pressure caused by the slide ring 74 moving the assembly upwardly against the downwardly facing annular shoulder 358 of the inner sleeve.

An outer locking sleeve 360 is mounted on the exterior of the latch sleeve 302 for limited longitudinal movement thereon. The locking sleeve 360 includes an upper section 362 to which is threaded the lower section 363. The upper section 362 is provided with a downwardly facing annular recess in which is disposed an O ring 364 which seals between the two sections to prevent flow of fluid therepast. The upper section 362 is provided also with an internal annular recess in which is disposed an O ring 366 which seals between the latch sleeve and the outer locking sleeve above a lateral port 367 provided in the lower section 363 of the locking sleeve.

The latch sleeve has an external annular flange 370 which in turn is provided with an external annular recess in which is disposed an O ring 372 which seals between the latch sleeve and the locking sleeve below the lateral port 367 and above the lateral port 374 of the locking sleeve. The locking sleeve is provided with an internal recess 376 defined by the downwardly facing shoulder 377 of the upper locking sleeve section 362 and the upwardly facing shoulder 378 of the lower locking sleeve section 363. The external annular flange 370 of the latch sleeve extends into the recess 376. The lock sleeve section 363 is also provided with an internal annular recess in which is disposed an O ring 380 which seals between the latch sleeve and the lock sleeve below the lateral ports 374 of the lock sleeve.

The outer locking sleeve 360 is releasably held in operative position relative to the latch sleeve 302 by means of a shear screw 382, threaded in suitable lateral bores of the upper latch sleeve section 303 and the upper lock sleeve section 362, against the downwardly biasing force

of the spring 385. The spring 385 has its opposite ends bearing against the upwardly facing shoulder 378 of the locking sleeve and the downwardly facing shoulder 387 of the flange 370 of the latch sleeve 302.

The wellhead is provided with an upwardly facing shoulder 390 which is adapted to engage the slide ring 354 of the lower seal assembly 350 to cause the seal assembly to be compressed against the shoulder 358 when the inner sleeve 330 is moved downwardly in the wellhead 13 to cause the seal element 353 to engage the inner seal surface 391 of the wellhead 13 and thus seal between the inner sleeve and the wellhead. The back-up rings 351 and 352, being of lead or of a similar flowable substance, will also tend to be deformed into engagement with the sealing surface 391 of the wellhead 13 and thus also serve to help seal between the inner sleeve and the wellhead. The upper seal 345 also seals between the inner sleeve and the seal surface 391 of the wellhead.

The conduits 31 and 32 are connected to the ports 367 and 374 of the outer locking sleeve 360 by means of suitable fittings 394 and 395 which are threaded in the outer portions of the lateral ports 367 and 374, respectively.

In use, when it is desired to secure the blowout preventers 14 and 15 and the guide pipe 22 to the wellhead 13, which may be located below the surface of a body of water, the latch 300 is secured to the blowout preventers by means of the flanges 17 and 18 and bolts 20 in the same manner as the latch 10 illustrated in FIGURE 1. The locking sleeve 360 is then in an upper position wherein the shoulder 400 is disposed above the dogs 306 so that the dogs are free to move outwardly into the enlarged lower bore section 402 of the locking sleeve. The locking sleeve is held in this upper position, against the resistance of the spring 385, by means of the shear screw 382. The entire assembly is then lowered downwardly through the water until the lower portion of the inner sleeve 330 enters into the wellhead 13. The dogs 306 cam outwardly as their teeth 315 pass over in the teeth 316 of the wellhead until they assume the position shown in FIGURE 6. The bores of the latched sleeve 302, the inner sleeve 330 and the wellhead are now in alignment and the seal 345 and the O ring 335 now prevent flow of fluids between the inner sleeve and the wellhead and between the inner sleeve and the latch sleeve, respectively.

The latch 300 is now secured to the wellhead 13 by the engagement of the dogs 315 with the threads 316 of the wellhead but can be disengaged from the wellhead due to the downwardly and inwardly sloping configurations of the upper surfaces of the dog teeth 315 and the upwardly and outwardly inclined lower surfaces of the threads 316 which will cam the dogs 306 outwardly when an upward vertical force is applied to the latch sleeve 302.

When it is desired to lock the latch 300 in engagement with the wellhead, the pressure of the hydraulic fluid in the conduit 32 is increased to increase the pressure in the chamber 405 between the latch sleeve and the outer lock sleeve and between the downwardly facing shoulder 387 of the flange 370 of the latch sleeve and the upwardly facing shoulder 378 of the locking sleeve. Simultaneously, the upper end of the conduit 31 is opened to permit outward flow of fluid from the chamber 406 between the locking sleeve 360 and the latch sleeve 302 and between the downwardly facing shoulder 377 of the locking sleeve and the upwardly facing shoulder 408 of the external flange 370 of the latch sleeve. When the pressure of the hydraulic fluid in the chamber 405 reaches a predetermined value, the shear screw 382 shears to permit the locking sleeve 360 to move downwardly. The force of the hydraulic fluid in the chamber 405 and the force of the spring 385 causes the locking sleeve to move downwardly to the position shown in FIGURE 6 where-

in the locking surface 409 of the locking sleeve extends outwardly of the locking dogs preventing the locking dogs from moving outwardly. It will be noted that the locking dogs are provided with downwardly and outwardly beveled upper shoulders which may be engaged by the downwardly and outwardly extending shoulder 400 which cams the dogs inwardly in the event that the dogs are not moved completely to their inner locking positions.

The latch 300 cannot now, therefore, be forced or removed from engagement with the wellhead by an upward force exerted thereon. It can still be removed from the wellhead, however, by rotation of the latch to threadedly disengage the teeth of the dogs from the threads of the wellhead. The latch 300 may also be disengaged from the wellhead by increasing the pressure in the chamber 406 while simultaneously permitting outward flow of fluid in the chamber 405 through the conduit 32 to cause the locking sleeve 360 to move upwardly from the position shown in FIGURE 6 to its original upper position on the latch sleeve against the force exerted by the spring 385. When the locking sleeve is again in its upper position, the dogs 306 are again free to be cammed outwardly so that an upward force exerted on the assembly will cause the dogs to be cammed outwardly out of engagement with the threads and thus free the blowout preventer assembly from the wellhead so that the entire assembly may be lifted therefrom.

The lateral port 336 of the latch sleeve affords communication between the chamber 405 and the chamber 340 so that when the pressure in the chamber 405 is increased, it causes the outer locking sleeve to move downwardly. Such increased pressure is communicated to the inner chamber 340 to cause the inner sleeve 330 to move downwardly relative to the latch sleeve 302. Such downward movement of the inner sleeve 330 causes the slide ring 354 to engage the upwardly facing shoulder 390 of the wellhead to compress the seal assembly 350 and thus create a better seal between the wellhead and the inner sleeve. In the event that excessive pressures arise in the wellhead, the pressure in the chamber 340 may be increased to effect a stronger seal between the inner sleeve and the wellhead.

If desired the hydraulic fluid which is forced into the chamber 405 may be of a thermo or time-setting type which solidifies or hardens with the passage of time so that after a predetermined period of time has elapsed, the locking sleeve will be held in its lowermost position not only by the force of the spring 385 but also by the now solidified substance which fills the lower chamber 405. If the hydraulic fluid is of the thermo-setting type, the necessary heat is provided by the well fluids which flow through the assembly or the hydraulic fluid may be heated at the surface and pumped into the chamber while hot. The use of setting fluids, such as cement, casein glue, or the like, precludes the necessity of maintaining pressure in the conduit 32 and the chamber 405 if it is for some reason found that the force of the spring 385 is not sufficient to keep the locking sleeve 360 in its lower locking position. If the fluid employed is of the setting type, the latch may be detached from the wellhead only by rotating the latch on the wellhead. This is also true if the wellhead is provided not with threads but with a plurality of external flanges as was discussed above.

It will now be seen that a new and improved latch for releasably connecting well tools, such as blowout preventers 14 and 15, to a wellhead 13 has been illustrated and described which includes an intermediate sleeve provided with locking means, such as the collets 38 or dogs 306, which are engageable with the threads on the upper end of the wellhead for releasably securing the latch to the wellhead.

It will further be seen that the releasable means are held in locked position to prevent separation of the latch from the wellhead by upward forces exerted on the latch by

the locking sleeve 360 illustrated in FIGURE 6 or the locking sleeve 80 illustrated in FIGURES 2 and 3.

It will further be seen that the locking sleeve in either case may be moved between an upper inoperative position and a lower locking position by means of hydraulic fluid transmitted through the conduits 31 and 32 to the latch whereby the latch may be remotely controlled.

It will further be seen that the latch includes an inner sleeve which is movable downwardly in the wellhead and has seal means which seal between the wellhead and the inner sleeve.

It will further be seen that the inner sleeve is provided with a seal assembly which is compressed by engagement with an upwardly facing shoulder of the wellhead into very tight sealing engagement with the wellhead when the inner sleeve is moved downwardly relative to the wellhead.

It will further be seen that the inner sleeve is moved downwardly in the wellhead, after the intermediate latch or collet sleeve has been rigidly secured to the wellhead, by fluid pressure which may be controlled remotely.

The foregoing description of the invention is explanatory only, and changes in the details of the construction illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed and desired to be secured by Letters Patent is:

1. A latch for a tubular member provided with threads comprising: a body; latch means carried by said body and resiliently engageable with said threads of said tubular member; lock means carried by said body and operatively associated within said latch means, said lock means being movable relative to said latch means between an inoperative position relative to said latch means and a locking position disposed to engage said latch means to prevent disengagement of the latch means from said threads; and remotely controlled fluid pressure operated means on said body and lock means responsive to fluid pressure for moving said lock means between said inoperative and locking positions.

2. Latch means for a tubular member provided with threads at one end thereof, comprising: a body; latch means carried by said body and telescopic relative to said threads for engagement with said threads; lock means carried by said body and movable longitudinally relative to said latch means to a position disposed to engage said latch means for preventing movement of said latch means from engagement with said threads; and remotely controlled fluid pressure operated means on said body and said lock means operable by fluid pressure for moving said lock means to said locking position.

3. A latch means for securing a well tool to a tubular member having a threaded end comprising: a body having a plurality of dependent resilient fingers provided with bosses engageable with said threads upon downward movement of said body relative to said tubular member; lock means carried by said body movable to a locking position relative to said resilient fingers engaging said fingers to prevent disengaging movement of said resilient fingers releasing said bosses from said threads; and fluid pressure operated means on said body and lock means for moving said lock means longitudinally with respect to said body between a position out of engagement with said resilient fingers to permit said fingers to move to disengage the bosses thereon from said thread and said position in which said lock means engages said resilient fingers to prevent disengagement of said boss from said threads.

4. A latch means for securing a well tool to a tubular member having a threaded end comprising: a body having a plurality of dependent resilient members provided with bosses engageable with said threads upon downward movement of said body relative to said tubular member;

lock means carried by said body movable to a locking position relative to said resilient members to prevent disengaging movement of said resilient members from said threads; and remotely controlled fluid pressure operated means on said body and said lock means responsive to fluid pressure for moving said lock means relative to said resilient members.

5. A latch means for securing a well tool to a tubular member having threads on one end thereof comprising: a collet having a plurality of dependent resilient collet fingers provided with bosses engageable with the threads of said tubular member, said collet fingers and said threaded end of said tubular member being telescopable relative to one another; a lock sleeve mounted for movement on said collet between an inoperative upper position wherein said lock sleeve allows movement of said bosses of said collet fingers out of engagement with the threads of said tubular member and a lower locking position wherein said lock sleeve engages said collet fingers to prevent the disengagement of said bosses with the threads of said tubular member; means on said lock sleeve and said collet having cooperable pressure fluid responsive means for moving said lock sleeve between said inoperative and said locking positions; and means for supplying fluid under pressure to said last mentioned means for selectively moving said lock sleeve between said operative and inoperative positions.

6. A latch for securing a well tool to a threaded end of a tubular member comprising: a collet having a plurality of dependent resilient fingers, said fingers having bosses engageable with said threads for releasably securing said collet to said threads upon telescoping movement of said collet relative to said threaded end of said tubular member; a lock sleeve slidably carried by said collet, one of said collet and said lock sleeve having a cylindrical recess, the other of said collet and said lock sleeve having an annular flange extending into said recess defining pressure chambers above and below said external flange; and means for selectively supplying fluid under pressure to said chambers to selectively move said lock sleeve between an upper inoperative position wherein said lock sleeve permits disengagement of said collet fingers from said threads and a lower locking position wherein said lock sleeve engages said collet fingers to prevent disengagement of said collet fingers with said threads.

7. A latch for securing a well tool to a threaded end of a tubular member comprising: a collet having a plurality of dependent resilient fingers, said fingers having bosses engageable with said threads for releasably securing said collet to said threads upon telescoping movement of said collet relative to said threaded end of said tubular member; a lock sleeve slidably carried by said collet, one of said collet and said lock sleeve having a cylindrical recess, the other of said collet and said lock sleeve having an annular flange extending into said recess defining pressure chambers above and below said annular flange; and means for selectively supplying fluid under pressure to said chambers to selectively move said lock sleeve between an upper inoperative position wherein said lock sleeve permits disengagement of said collet fingers from said threads and a lower locking position wherein said lock sleeve engages said collet fingers to prevent disengagement of said collet fingers with said threads, said fluid solidifying with time in one of said upper chambers to immovably lock said lock sleeve in its lower locking position.

8. A latch for securing well tools to a tubular member having external threads at one end thereof comprising: a collet having means at its upper end for attachment to a well tool to be secured to the tubular member and having dependent resilient collet fingers provided with thread bosses engageable with said threads of said tubular member; a sleeve carried by said collet and movable between an upper inoperative position wherein said sleeve permits outward movement of said collet fingers from engagement

with said threads of the tubular member and a lower locking position wherein said sleeve is telescoped over and engages said collet fingers to prevent their disengagement from said threads of the tubular member, said sleeve having an internal annular recess, said collet having an external annular flange extending into said recess to form fluid tight upper and lower chambers; and means for introducing fluid under pressure selectively into said upper and lower chambers.

9. A latch for securing well tools to a tubular member having external threads at one end thereof comprising: a collet having means at its upper end for attachment to a well tool to be secured to the tubular member and having dependent resilient collet fingers provided with bosses engageable with said threads of said tubular member; a sleeve carried by said collet and movable between an upper inoperative position wherein said sleeve permits outward movement of said collet fingers from engagement with said threads of said tubular member and a lower locking position wherein said sleeve is telescoped over and engages said collet fingers to prevent their disengagement from said threads of the tubular member, said sleeve having an internal annular recess, said collet having an external annular flange extending into said recess to form fluid tight upper and lower chambers; means for selectively introducing fluid under pressure selectively into said upper and lower chambers; and releasable means for holding said sleeve in its upper position.

10. A latch for securing well tools to a tubular member having external threads at one end thereof comprising: a collet having means at its upper end for attachment to a well tool to be secured to the tubular member and having dependent resilient collet fingers provided with bosses engageable with said threads of said tubular member; a sleeve carried by said collet and movable between an upper inoperative position wherein said sleeve permits outward movement of said collet fingers out of engagement with said threads and a lower locking position wherein said sleeve is telescoped over and engages said collet fingers to prevent their disengagement from said threads of the tubular member, said sleeve having an internal annular recess, said collet having an external annular flange extending into said recess to form fluid tight upper and lower chambers; means for selectively introducing fluid under pressure selectively into said upper and lower chambers; releasable means for holding said sleeve in its upper position; an inner sleeve carried by said collet having seal means on the lower end thereof for sealing between an internal wall of said tubular member and said inner sleeve, said collet having an internal annular recess, said inner sleeve having an external flange extending into said internal recess of said collet to provide a fluid tight chamber, said collet having means for connecting said lower chamber to said last mentioned chamber whereby said inner sleeve is moved downwardly by fluid under pressure introduced into said lower chamber.

11. A latch for securing well tools to a tubular member having external threads at one end thereof comprising: a collet having means at its upper end for attachment to a well tool to be secured to the tubular member and having dependent resilient collet fingers provided with bosses engageable with said threads of said tubular member; a sleeve carried by said collet and movable between an upper inoperative position wherein said sleeve permits outward movement of said collet fingers out of engagement with said threads of said tubular member and a lower locking position wherein said sleeve is telescoped over and engages said collet fingers to prevent their disengagement from said threads of the tubular member, said sleeve having an internal annular recess, said collet having an external annular flange extending into said recess to form fluid tight upper and lower chambers; means for selectively introducing fluid under pressure selectively into said upper and lower chambers; releasable means for holding said sleeve in its upper posi-

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tion; an inner sleeve carried by said collet having seal means on the lower end thereof for sealing between an internal wall of said tubular member and said inner sleeve, said collet having an internal annular recess, said inner sleeve having an external flange extending into said internal recess of said collet to provide a fluid tight chamber, said collet having means for connecting said lower chamber to said last mentioned chamber whereby said inner sleeve is moved downwardly by fluid under pressure introduced into said lower chamber; said seal means comprising: a deformable seal member and movable means mounted on said sleeve and engageable by said tubular member when said inner sleeve is moved downwardly in said collet to cause said seal to be compressed to effect a more effective seal between said sleeve and said collet member.

12. A latch for detachably securing a well tool to a tubular member provided with threads comprising: a collet having means at its upper end for attachment to a well tool and having a plurality of dependent resilient collet fingers provided with bosses engageable with threads of said tubular member, said collet being telescopic in said tubular member, said collet fingers flexing inwardly over said threads during such downward telescopic movement of the collet into the said tubular member; and an internal lock sleeve carried by said collet and movable downwardly relative to said collet between said collet fingers to engage said collet fingers to prevent inward flexing of said collet fingers out of engagement with said threads.

13. A latch for detachably securing a well tool to a tubular member provided with threads comprising: a collet having means at its upper end for attachment to a well tool and having a plurality of dependent resilient collet fingers provided with bosses engageable with threads of said tubular member, said collet being telescopic in said tubular member, said collet fingers flexing inwardly over said threads during such downward telescopic movement of the collet into the said tubular member; and an internal lock sleeve carried by said collet and movable downwardly relative to said collet between said fingers to engage said collet fingers to prevent inward flexing of said collet fingers out of engagement with said threads, said lock sleeve having seal means on the lower end thereof, said seal means comprising a deformable seal member and movable means mounted on said sleeve and engageable by said tubular member when said inner sleeve is moved downwardly in said collet to cause said seal to be compressed to effect a more effective seal between said sleeve and said collet member.

14. A latch for detachably securing a well tool to a tubular member provided with threads comprising: a collet having means at its upper end for attachment to a well tool and having a plurality of dependent resilient collet fingers provided with thread bosses engageable with threads of said tubular member, said collet being telescopic in said tubular member, said collet fingers flexing inwardly over said threads during such downward telescopic movement of the collet into the said tubular member; an internal lock sleeve carried by said collet and movable downwardly relative to said collet between and engaging said collet fingers to a lower locking position to prevent inward flexing of said collet fingers out of engagement with said threads; and remotely controlled means for moving said lock sleeve downwardly relative to said collet member to said lower locking position.

15. A latch for detachably securing a well tool to a tubular member provided with threads comprising: a collet having means at its upper end for attachment to a well tool and having a plurality of dependent resilient collet fingers provided with thread bosses engageable with threads of said tubular member, said collet being telescopic in said tubular member, said collet fingers flexing inwardly over said threads during such downward

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telescopic movement of the collet into the said tubular member; an internal lock sleeve carried by said collet and movable downwardly relative to said collet between and engaging said collet fingers to a lower locking position to prevent inward flexing of said collet fingers out of engagement with said threads; remotely controlled means for moving said lock sleeve downwardly relative to said collet member to said lower locking position; and means on the lower end of said lock sleeve for sealing between said lock sleeve and said tubular member.

16. A latch for a tubular member provided with longitudinally spaced flanges at one end thereof comprising: latch means telescopic relative to said end and having shoulder means thereon engageable in meshed relationship with said flanges; lock means movable longitudinally relative to said latch means for engaging said latch means to prevent movement of said latch means freeing said shoulder means thereon from engagement with said flanges; and an inner sleeve movable longitudinally relative to said latch means and telescopic in said tubular member, said inner sleeve having seal means for sealing between said inner sleeve and said tubular member, said seal means being deformable; and movable means mounted on said inner sleeve and engageable by said tubular member when said inner sleeve is moved downwardly in said wellhead to cause said seal means to be compressed to effect a more effective seal between said inner sleeve and said tubular member.

17. A latch for a tubular member having a plurality of external spaced flanges on one end thereof comprising: a latch sleeve telescopic over said end of said tubular member, said latch sleeve having a plurality of latch means biased inwardly toward engagement with said flanges; said latch means having shoulders thereon engageable with said flanges in meshing holding relationship; a lock sleeve movable longitudinally with respect to said latch sleeve from a position out of engagement with said latch means to a position on said latch sleeve to engage said latch means for preventing outward movement of said latch means relative to said tubular member whereby disengagement of said shoulders of said latch means from said flanges by an upward force exerted on said latch sleeve is precluded; and an inner sleeve mounted in said latch sleeve for limited longitudinal movement relative thereto, said inner sleeve being telescopic into said tubular member, said inner sleeve being provided with seal means for sealing between said tubular member and said inner sleeve.

18. A latch for securing a well tool to a tubular member having spaced external flanges on one end thereof comprising: a latch sleeve having a plurality of latch means engageable with said spaced flanges, said latch sleeve and said threaded end of said tubular member being telescopic relative to one another; said latch means having shoulders thereon lockingly engaging said spaced flanges when said latch sleeve is telescoped over said tubular member; a lock sleeve mounted for limited longitudinal movement on said latch sleeve between an inoperative position wherein said lock sleeve does not prevent disengagement of said latch means from said flanges and a lower locking position, said lock sleeve when in said locking position engaging said latch means to prevent disengagement of said shoulders of said latch means from said flanges; cooperable fluid pressure responsive means on said lock sleeve and said latch sleeve for moving said lock sleeve between said inoperative and said locking position.

19. A latch for securing a well tool to a tubular member having spaced external flanges on one end thereof comprising: a latch sleeve having a plurality of latch means engageable with said spaced flanges, said latch sleeve and said one end of said tubular member being telescopic relative to one another; said latch means having shoulder means thereon lockingly engaging said spaced flanges when said latch sleeve is telescoped over

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said tubular member; a lock sleeve mounted for limited longitudinal movement on said latch sleeve between an inoperative position wherein said lock sleeve does not prevent disengagement of said latch means with said flanges and a lower locking position, said lock sleeve when in said locking position engaging said lock means to prevent disengagement of said shoulder means of said latch means from said flanges; cooperable fluid pressure responsive means on said lock sleeve and said latch sleeve for moving said lock sleeve between said inoperative and said locking position; and means for supplying fluid under pressure to said pressure responsive means for selectively moving said lock sleeve between said operative and inoperative positions.

20. A latch for securing a well tool to an end of a tubular member having a plurality of external spaced flanges thereon comprising: a latch sleeve having a plurality of latch dogs having projecting internal teeth thereon, said latch dogs being movable between inner locking positions and outer inoperative positions, said dogs having their internal teeth engageable with said spaced flanges for releasably securing said latch sleeve to said flanges upon telescoping movement of said latch sleeve relative to said tubular member; a lock sleeve slidably carried by said latch sleeve, said lock sleeve being movable relative to said latch sleeve between an upper inoperative position out of engagement with said latch dogs and a lower locking position wherein said lock sleeve engages said latch dogs to prevent outward releasing movement thereof out of engagement with said flanges; one of said latch sleeve and said lock sleeve having a cylindrical recess, the other of said latch sleeve and said lock sleeve having an annular flange extending into said recess defining separate upper and lower pressure fluid chambers above and below said annular flange; and means for supplying fluid under pressure to said chambers for moving said lock sleeve between said upper inoperative position wherein said lock sleeve permits outward movement of said dogs and said lower locking position wherein said lock sleeve engages said dogs to prevent outward movement of said dogs.

21. A latch for securing a well tool to an end of a tubular member having a plurality of external spaced flanges thereon comprising: a latch sleeve having a plurality of latch dogs, said latch dogs being movable between inner locking positions and outer inoperative positions, said dogs having inwardly extending teeth engageable with said spaced flanges for releasably securing said latch sleeve to said flanges upon telescoping movement of said latch sleeve relative to said tubular member; a lock sleeve slidably carried by said latch sleeve, said lock sleeve being movable relative to said latch sleeve between an upper inoperative position out of engagement with said latch dogs and a lower locking position wherein said lock sleeve engages said latch dogs to prevent outward disengaging movement of said dogs from said flanges; one of said latch sleeve and said lock sleeve having a cylindrical recess, the other of said latch sleeve and said lock sleeve having an annular flange extending into said recess defining separate upper and lower pressure fluid chambers above and below said annular flange; and means for supplying fluid under pressure to said chambers for moving said lock sleeve between said upper inoperative position wherein said lock sleeve does not prevent outward movement of said dogs and said lower locking position wherein said lock sleeve engages said dogs to prevent outward movement of said dogs; said fluid solidifying with time in said lower chamber to immovably lock said lock sleeve in its lower locking position.

22. A latch for a tubular member provided with longitudinally spaced flanges at one end thereof comprising: latch means telescopic relative to said end and having shoulder means thereon engageable with said flanges; tubular lock means movable longitudinally relative to and into circumferential juxtaposition with said latch means

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for engaging said latch means to prevent movement of said latch means freeing said shoulder means thereon from engagement with said flanges; and an inner sleeve movable longitudinally relative to said latch means and telescopic in said tubular member, said inner sleeve having seal means for sealing between said inner sleeve and said tubular member.

23. A latch means for securing a well tool to a tubular member having a plurality of spaced flanges adjacent one end thereof, said latch means comprising: a body telescopic relative to said one end of said tubular member, said body having a plurality of latch means carried thereby engageable in holding relationship with said flanges of said tubular member; and lock means carried by said body and movable thereon relative to said latch means from a position out of operative engagement with said latch means to a locking position wherein said lock means is disposed to engage said latch means to prevent disengaging movement of said latch means from said flanges; and means for moving said lock means longitudinally of said body.

24. A latch for a tubular member having a plurality of external longitudinally spaced flanges adjacent one end thereof, said latch comprising: a latch sleeve telescopic over said one end of said tubular member, said latch sleeve having a plurality of latch means thereon biased inwardly toward engagement with said flanges; said latch means each having shoulders thereon engageable with said flanges in meshing holding relationship; a lock sleeve movable longitudinally of said latch sleeve from a position out of position to engage said latch means to a position on said latch sleeve disposed to engage said latch means relative to said flanges of said tubular member whereby disengagement of said shoulders of said latch means from said flanges by a longitudinal force exerted on said latch sleeve is precluded; and means on said body and on said lock sleeve operable from a remote point for moving said lock sleeve longitudinally with respect to said latch sleeve.

25. A latch means for securing a well tool to a tubular member having a plurality of longitudinally spaced flanges adjacent one end thereof, said latch means comprising: a body telescopic relative to said one end of said tubular member, said body having latch means thereon engageable with said flanges, said latch means comprising a plurality of dogs each having teeth thereon engageable between said spaced flanges, means biasing said dogs toward a position in which said teeth are disposed to engage said flanges; and lock means carried by said body and movable longitudinally thereon relative to said latch means from a position wherein said lock means is out of position to engage said latch means to a locking position relative to said latch means wherein said lock means is disposed to engage said latch means to prevent disengaging movement of said teeth of said dogs of said latch means from locking engagement with said flanges; and means on said body and said lock means operable by fluid pressure for moving said lock means relative to said latch means on said body.

26. A latch means for securing a well tool to a tubular member having a plurality of longitudinally spaced flanges adjacent one end thereof, said latch means comprising: a tubular body telescopic over said one end of said tubular member, said body having a plurality of latch means thereon engageable with said flanges of said tubular member; lock means carried by said body movable longitudinally with respect to said latch means from a position out of position to engage said latch means to a locking position relative to said latch means wherein said lock means is disposed to engage said latch means to prevent disengaging movement of said latch means from engagement with said flanges of said tubular member, said latch means comprising a plurality of dogs each having a plurality of projecting teeth engageable between

said spaced flanges of said tubular member, said flanges and said teeth of said dogs being provided with cam shoulders whereby longitudinal movement of said body relative to said tubular member causes said dogs to be cammed out of engagement with said spaced flanges when said lock means is out of locking position relative to said latch means; and means on said body and said lock means operable by fluid pressure for moving said lock means relative to said latch means to position to engage said dogs to prevent disengagement of said teeth from said flanges. 10

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